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closed-circuit coil and the disk. These currents are in approximately the same phase. If the closed-circuit coil be placed at an angle with the main coil, then there will be a rotation of the disk, the rotary effort increasing until the angle between the coils is forty-five degrees. The shaft of the disk is geared to a train of counting wheels, which record the number of revolutions. On the lower part of the shaft are light air-vanes to resist the rotation. When the closed-circuit coil is set, and we have an alternating current passing through the main coil, there is a rotary effort on the disk proportional to the current; there is a resistance to the motion due to the air-vanes and the friction of the pivots. It is found that the result is a speed proportional, within narrow limits, to the current passing in the main coil. The following figures are taken from the test of a 40-ampère meter:—

| Current in Amperes. | Reading of Meter. | Percentage of Error. |
|---------------------|-------------------|----------------------|
| 2.06                | 1.60              | —                    |
| 4.02                | 4.07              | + 1.2                |
| 5.00                | 4.95              | — 1.0                |
| 9.90                | 10.02             | + 1.2                |
| 15.00               | 15.10             | + 0.7                |
| 20.00               | 20.00             | 0.0                  |
| 29.70               | 30.00             | + 1.0                |
| 37.40               | 37.00             | — 1.1                |
| 49.30               | 45.40             | — 7.9                |

In the last case the meter was overloaded. It would seem rather doubtful, however, even acknowledging the accuracy of the instrument tested, whether the friction of the moving parts will remain constant in use. Still experience must decide its practical value.

#### BOOK-REVIEWS.

*A New English Dictionary on Historical Principles.* Ed. by JAMES A. H. MURRAY. Part IV. Sections 1 and 2. Oxford, Clarendon Pr. 1<sup>o</sup>. (New York, Macmillan, \$3.25.)

WE noticed the first instalment of this great work in *Science* for April 25, 1884, and we are now glad to chronicle the appearance of the fourth part, completing the first volume (A and B) and beginning the second. It is superfluous to praise the work, especially after the high commendations it has everywhere received. It is generally acknowledged to be the best dictionary of any language, and when finished will be indispensable to every thorough student of English. Both its etymologies and its definitions are up to the standard of the best scholarship, while in spelling and pronunciation it is probably as satisfactory as any dictionary of English can be. The typography also is excellent; the definitions, quotations, and other items under each word being clearly distinguished by different kinds and sizes of type. The number of illustrative quotations taken from some five thousand writers of the past seven centuries is immense; and in this respect, as well as in others, the work will serve as the basis of all English dictionaries hereafter.

The number of words in the first volume is 31,254, of which 15,123 are under A, and 16,131 under B. Some of these, however, are merely variant forms or inflections of the main words, while others are special combinations explained under the main words; so that the number of main words alone is only 22,232, of which 12,183 are under A, and 10,049 under B. In a dictionary dealing with seven centuries of English literature there are necessarily many obsolete words; and yet it is found, that, "of the whole English vocabulary on record since the twelfth century (so far as A and B show), more than three-fourths is still in current use." The development of the language in recent times, however, has been great, owing chiefly to the progress of physical science and the consequent introduction of new scientific terms. Yet the dictionary does not contain by any means all the terms used in science, but only such as are used more or less as English words; the generic names in natural history, for instance, being mostly excluded.

In a dictionary based on historical principles, the subject of

etymology is especially prominent; yet to ascertain the origin and derivation of some words has been found impossible, and the editor thinks that they are comparatively recent creations of the English-speaking peoples. Among such words he mentions 'bang,' 'blight,' 'blot,' 'blunder,' 'blunt,' 'bounce,' 'bunch,' and many others. One of the most valuable features of the work is the endeavor to trace, so far as possible, the derivation of the various meanings of a word from the original one. This subject is of great importance as illustrating the history of thought, and has been too much neglected by philologists hitherto. Sometimes the development of meaning is simple and easy to trace; but in some cases it is quite difficult, especially when the development takes place on divergent lines. For instance, the word 'canvas' is from the Latin *cannabis* ('hemp'), and the connection of most of its meanings with the original one can be readily traced; but, when used for the act of soliciting votes before an election, the affiliation is not apparent.

The difficulty of preparing such a work as this dictionary is immense. Its inception dates from a resolution of the English Philological Society passed in 1857, at the suggestion of the late Archbishop Trench. But before the composition of the dictionary could be begun, three and a half million quotations had to be made by some thirteen hundred readers; and the preparation of the work itself has proved much more difficult than the editors anticipated. Arrangements have been made, however, for more rapid progress hereafter; and Mr. Henry Bradley, who has been an assistant editor hitherto, is now engaged independently on the third volume, so that some of us, at least, may hope to see the completion of the work.

*Facts and Opinions relating to the Deaf, from America.* By ALEXANDER GRAHAM BELL. London. 8<sup>o</sup>.

THE above is the title of a pamphlet containing much valuable matter which Professor Bell collected in preparation of his report to the Royal Commission appointed by the British Government to inquire into the condition of the deaf. No one is so well fitted to be the spokesman of American activity in this direction as Professor Bell, and no one has proved himself more capable of increasing our knowledge of the deaf as a class, and the means of improving their condition. The report before us contains the answers of the superintendents of American schools for the deaf to a long circular letter drawn up by Professor Bell. Five general problems are discussed: (1) 'Visible Speech;' (2) the aural method; (3) intermarriage of deaf-mutes, and possibility of a deaf variety of the human race; (4) the self-supporting character of the education of deaf-mutes; (5) articulation-teaching.

(1) With regard to the use of 'Visible Speech,' the fact that thirty-one institutions in which it has been introduced it has continued to be employed in only seventeen, argues against its universal applicability. The reasons for its dismissal are generally its difficulty of comprehension and tedium of learning. None the less, its hearty indorsement by so many superintendents shows that it has more in its favor than against it.

(2) The question of developing latent powers of hearing, and especially vocalization, in persons usually termed deaf but really only hard of hearing, is discussed at great length, with the general conviction that much more can be done in this direction than is usually understood. The good done in this way is not only a more or less questionable improvement of the physical hearing, but very markedly a direction of the attention to a class of sensations usually neglected, and thus increasing the accuracy of their perception. The mechanical aids to securing for the deaf a semi-hearing of their own articulations are various, and variously valued, though all seem susceptible of improvement.

(3) Doubtless the most important topic of the inquiry is that concerning the heredity of the deaf-mute class. Professor Bell, it is well known, has written a memoir urging that the tendency of the too close association of deaf-mutes with one another, as is now in vogue, is towards the formation of a deaf variety of the human race; his statistics proving that a constantly increasing proportion of the descendants of deaf-mute parents are deaf-mutes. The superintendents of schools, however, maintain that the bulk of their experience is against the truth of this thesis. Many recommend